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Gender in STEM Education: an Exploratory Study of Student Perceptions of Math and Science Instructors in the United Arab Emirates

Nausheen Pasha-Zaidi[1] **· Ernest Afari**[1]

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Abstract The current study addresses student perceptions of math and science professors in the Middle East. Gender disparity in science, technology, engineering, and math (STEM) education continues to exist in higher education, with male professors holding a normative position. This disparity can also be seen in the United Arab Emirates. As female participation in STEM education lags behind men, it is possible that gender stereotypes may influence students' first impressions of male and female instructors. The United Arab Emirates provides a unique context to study this phenomenon as it is a traditional patriarchal society that is highly dependent on the engineering discipline, especially within the oil and gas sectors. A total of 176 undergraduate students from 2 universities in the United Arab Emirates completed a survey about teaching effectiveness based on their perceptions of photographs of hypothetical male and female instructors. A factor analysis of survey items revealed 2 main subcategories of teacher effectiveness: namely teacher warmth and professionalism. A 2-way between-groups analysis of variance was conducted to explore the impact of teacher gender and student gender on perceptions of overall teaching effectiveness, as well as their perceptions of teacher warmth and professionalism. Findings revealed that there was a significant cross-gender effect on student perceptions of math and science instructors in the United Arab Emirates.

Keywords Gender · Math and science teachers · Students' perceptions · Teaching effectiveness

✉ Nausheen Pasha-Zaidi
nausheenpasha@outlook.com

Ernest Afari
eafari@pi.ac.ae

[1] The Petroleum Institute, PO Box 2533, Abu Dhabi, United Arab Emirates

Introduction

People make instant character judgments of others based on first impressions elicited from social categorizations such as age, gender, and race (Fiske, 1998). Willis & Todorov (2006) noted that individuals make character judgments based on the physical appearance of a stranger within a tenth of a second. Berry's (1990) research found that people can make trait judgments with significant rater agreement using only photographs presented for 10 s. Such rapid responses are a feature of human cognition to lessen the mental effort required to process the overwhelming amount of information which bombards the social and sensory domains (Fiske, 2004; Quinn, Macrae & Bodenhausen, 2003). Perceptions based on categories, rather than individuals, are thus a way to conserve mental energy. Much of the research on stereotype activation related to social categorization has been conducted using photographs as visual stimuli (Dixon & Maddox, 2005; Griffin & Langlois, 2006; Wheeler & Fiske, 2005). The present study uses this phenomenon to explore the effect of gender on students' first impressions of math and science instructors in the United Arab Emirates. Despite gains in female employment in math and science fields, the number of women in these sectors continues to be far below the number of men (Mahani & Molki, 2011). Thus, in line with contemporary models of impression formation, we posit that student perceptions of math and science teachers would be affected by gender stereotypes, especially in the absence of other social cues that may counter stereotype activation.

Although gender differences in math and spatial ability may exist, they do not wholly explain the underrepresentation of women in math and science fields (Ceci & Williams, 2010). In fact, a recent study of Chilean students (Gandara & Silva, 2015) found no significant gender differences in interest related to the pursuit of science, technology, engineering, and math (STEM) majors based on the similar proportions of males and females taking the prerequisite entrance examinations. Discrimination in favor of men, however, is a factor that has been historically discussed with regard to the gender gap (Steinpreis, Anders & Ritzke, 1999; Trix & Psenka, 2003). Recent studies have countered this argument as well (Committee on Gender Differences in the Careers of Science, Engineering, and Mathematics Faculty, 2010; Ginther & Kahn, 2006; Marsh, Bornmann, Mutz, Daniel & O'Mara, 2009). Ceci & Williams (2010) argue that the lower number of women in math and science fields may be more related to choice factors. Females with high aptitude towards math, for example, may be less interested in math-related careers compared to their male counterparts (Lubinski & Benbow, 2006).

However, social cues may also play a part. Although research shows that gender disparity in the field may not necessarily be related to discrimination in terms of access to jobs, promotions, and academic grants, the lack of women in STEM professions may signal the idea that women are less welcome or do not really belong (Walton & Cohen, 2007). Subtle cues in the environment and stereotypically male objects in the classroom (such as Star Trek posters or video games) (Cheryan, Plaut, Davies & Steele, 2009; Murphy, Steele & Gross, 2007) may reinforce this notion and affect female participation in STEM professions. Moss-Racusin, Dovidio, Brescoll, Graham & Handelsman (2012) found that faculty perceptions of undergraduate science students favored male students over female students. As a result, those women who do pursue higher studies in math and science fields tend to do so with few female role models and a high probability of having male professors as their supervisors (Ceci & Williams, 2010). This increases the likelihood that students of both genders may expect a male professor for their math and science courses at the university level. So, how does this expectation affect student perceptions of male and female professors in the STEM field?

Stout, Dasgupta, Hunsinger & McManus (2011) noted the importance of female professors for predicting self-efficacy and commitment to the STEM profession among female students, thus increasing their self-concept despite the existence of negative stereotypes. This supports the study by Bettinger & Long (2005) wherein female faculty members were shown to have the potential to increase female students' interest in a subject, especially within the math and science professions. Despite these aspects supporting the participation of female faculty in STEM fields, gender stereotypes may be more prevalent with regard to student perceptions of their instructors simply because the number of female professors is outweighed by the number of male professors (Bennett, 1982).

Gender and Higher Education

A great deal of research has been done on gender bias and student evaluations in higher education with some conflicting results. Freeman (1994) found no difference between male and female ratings of effectiveness, whereas Basow (2000) and Sprinkle (2008) found that female students rated female faculty higher, while male students preferred male faculty. In a recent study of online education (MacNell, Driscoll & Hunt, 2014), students rated faculty higher when they perceived the instructor to be male, regardless of the actual gender of the online instructor. Bachen, McLoughlin & Garcia's (1999) study noted that gender schema and stereotypes of masculine and feminine traits affect students' evaluations of male and female instructors. Analysis of student comments in the study supported the notion that male instructors are praised for their professionalism and their focus on providing a challenging classroom, whereas female professors are criticized for the same qualities.

Research indicates that student evaluations are linked to student expectations of professors (Andersen & Miller, 1997), and if a professor meets those expectations, the evaluations are generally positive. Conversely, not meeting expectations results in negative teacher evaluations (Kierstead, D'Agostino & Dill, 1988). As female professors are expected to be warmer, more approachable, and more caring than male professors (Bennett, 1982), they may be judged more harshly if they do not adhere to this deferential stereotype of femininity. Due to the normative position of male professors in STEM fields, female professors of math and science courses may face a double bind. Although they are expected to show feminine qualities such as empathy and compassion (Bennett, 1982), they are also expected to display masculine qualities of rigor and authority which are expected of their position (Kierstead et al., 1988). When displaying stereotypically feminine qualities, they may be judged as less professorial, and by displaying stereotypically masculine qualities, they may violate the expectations associated with their gender and be judged as too masculine (Andersen & Miller, 1997; Valian, 1998).

Cunningham, Sartore, Chaney & Chaney (2009) found that women may be perceived as professorial if the content of the course is exclusive to women. Specifically, they found that female students viewed female instructors as better fit to teach a lecture on women's health; thus, female instructors were rated higher by female students in this context. Bianchini, Lissoni & Pezzoni (2013) also found gender bias favoring male faculty in an Italian engineering college and attributed these findings to the low percentage of female students in the programs.

Gender and Higher Education in the United Arab Emirates

The United Arab Emirates is one of the countries in the Gulf Cooperation Council (GCC). In terms of demographic profile, the population in the United Arab Emirates is overwhelmingly male and expatriate, with only 20 % of the people residing in the United Arab Emirates being local Emiratis (Kapiszewski, 2006) and approximately 30 % being female (United Arab Emirates National Bureau of Statistics, 2010).

As the economy in the United Arab Emirates is fueled by the oil and gas industry, innovation in science and technology is an essential component of continued growth. Despite having one of the highest per capita incomes in the world, the public education system in the United Arab Emirates continues to struggle. Male Emirati students have lower levels of achievement and higher dropout rates than female Emirati students, who make up about 70 % of the higher education population (Ridge, 2010). This, however, does not extend to female participation in STEM education. Although the trend shows a positive growth rate towards female enrollment in STEM majors, the overall percentage of women in engineering fields in the United Arab Emirates continues to be lower than that of men (Mahani & Molki, 2011). Thus, even though students perceive STEM as an empowering field for women (Makhmasi, Zaki, Barada & Al-Hammadi, 2012), there is still a dearth of female students pursuing STEM education.

A study of female engineering students in the United Arab Emirates (Mahani & Molki, 2011) found that students who had more confidence in their mathematical abilities were more likely to pursue engineering degrees. This is in line with existing research (Ceci & Williams, 2010). However, the lack of female role models was not a factor in their decision-making. In fact, students in the study were mainly encouraged by their fathers to study engineering, and a majority of respondents did not feel that it was important to have a female engineering professor. This is an interesting phenomenon as researchers have suggested that a lack of female role models in STEM fields may be a factor contributing to the gender disparity in the discipline (Bettinger & Long, 2005; Stout et al., 2011)

Another aspect to consider is student perceptions of university instructors. Recent studies in the United Arab Emirates have addressed sociocultural perceptions of teachers in providing English language instruction (King, 2013; Norton & Syed, 2003; Pasha-Zaidi, Holtby, Afari, & Thomson, 2014). In the study by Pasha-Zaidi, et al. (2014), ethnicity was a factor determining United Arab Emirates students' perceptions of native-English ability, confirming previous studies that have noted the prevalence of similar stereotypes in English language teaching (Ali, 2009; Amin, 1997). This is an important aspect to consider in the United Arab Emirates as English is the language of instruction in higher education and a lack of English proficiency is linked to lower levels of student interest in pursuing STEM education (Makhmasi et al., 2012). The present study extends the research by Pasha-Zaidi, et. al. (2014) to explore the perceptions of students regarding STEM instructors.

Stereotyping and Impression Formation

To fill the gap in the extant literature, the aim of this study was to examine the effect of gender on perceptions of math and science instructors at the university level. We chose to elicit responses to hypothetical instructors rather than instructors with whom students were familiar in order gain information about perceptions based only on the impressions that could be formed using static visual stimuli (Berry, 1990). We posited that the influence of gender stereotypes would affect first impressions in a similar manner as the original study where stereotypes of ethnicity affected student perceptions of native-English ability.

Stereotyping and impression formation have been addressed by researchers in social psychology for the past few decades (Heilman, 1984; Fiske & Neuberg, 1990; Macrae, Mitchell & Pendry, 2002). Stemming from Allport's seminal work (1954), stereotyping has been described as a way to conserve cognitive energy by simplifying information based on social categories such as gender, race, and age. Stereotype activation has been found to influence judgments via numerous forms of stimuli, including job titles (Merritt & Harrison, 2006), names (Steinpreis et al., 1999), and visual cues (Branscombe & Smith, 1990; Shah & Ogden, 2006). Photographs have been used in experimental studies to activate stereotypes which have then been found to influence participants' responses to subsequent stimuli. In Shah & Ogden's (2006) experimental study of patients' perceptions of doctors, photographs were used to determine the influence of gender on patients' evaluations of hypothetical doctors. Participants in the study rated female doctors higher than male doctors with regard to having better personal manners, better explanation skills, and better technical ability. Additionally, Branscombe & Smith (1990) found that gender stereotypes cued solely from photographs of job applicants affected the hiring decisions that were made. Other studies have used photographs to ascertain perceptions of personal efficacy and character based on physical appearance (Buck & Tiene, 1989; Little & Perrett, 2007).

The focus on unfamiliar male and female faces in STEM education provides a context to study the impact of gender stereotypes on students' initial perceptions of math and science instructors. As initial impressions tend to highlight individuals who do not fit with the majority (Fiske, 2004) and STEM education is a male-dominated discipline, we hypothesized that gender stereotypes would affect student perceptions of hypothetical math and science instructors, given the absence of social cues to counter stereotypical judgments.

Participants

The current study surveyed 240 students in two universities in the United Arab Emirates. One is a government-sponsored engineering university that is segregated by gender, while the other is a private, co-educational institution offering a variety of majors, including engineering, communications, and business. Only data for students majoring in STEM fields were utilized and incomplete surveys were removed from data analysis. The final participant count was 176 students, 125 males and 51 females. The majority of respondents (79 %) were enrolled at the government institute (61 % male and 18 % female). The remaining 21 % were enrolled at the private university

(12 % male and 9 % female). Student ages ranged from 17 to 30 years. Eighty percent of participants were United Arab Emirates nationals and 66 % were in first year university preparatory courses. All students in the first year preparatory courses were United Arab Emirates nationals taking remedial courses in English and math to obtain the minimum entrance criteria for matriculation as freshmen. Such bridging programs are often instituted in universities to help students gain the knowledge and expertise required to be successful in their higher education courses (Moru, Persens & Breiteig, 2010). Expatriate students represented a variety of nationalities, including Syrian, Jordanian, Pakistani, Indian, and American.

Materials and Methods

As the goal of this study was to determine student perceptions of unfamiliar instructors, the focus on physical appearance was the key variable to provide input for student responses. Thus, students in the present study were given a photograph of a hypothetical male or female math/science instructor and asked to rate that instructor based on the visual information provided.

The teacher effectiveness scale developed by Pasha-Zaidi, et al. (2014) was utilized to assess student expectations of the hypothetical teacher. Although there are many instruments available in the literature to assess teacher effectiveness, the scale employed in this study was developed using items that appear in actual course evaluation tools that students use each semester. This allowed students to be familiar with the items and the instrument protocols. As English is a second language for many students, we felt that using a tool with items that may be familiar to students would help them provide more accurate first impressions. Additionally, as the scale had an adequate reliability in the original study (Cronbach's alpha=.79) and was used with students from the same population, it was deemed an appropriate tool. The instrument contained 14 items on a four-point Likert scale (1=strongly disagree, 4= strongly agree) to force students to make a judgment based on the limited information provided (see Appendix).

Analysis of the Scale

The underlying structure of the teacher effectiveness scale was explored using exploratory factor analysis (EFA). The 14 items were subjected to principal components analysis (PCA) using SPSS version 22. The suitability of data for factor analysis was assessed before performing PCA.

Reliability

Analyses were conducted to determine the consistency of the items within each scale. The resulting Cronbach alpha value for the 14-item teacher effectiveness scale was .87. The reliability analysis of the professionalism scale (seven items) was .781 and the warmth scale (seven items) was .778. All the Cronbach alpha values exceeded the recommended value of .70, indicating adequate internal consistency.

Exploratory Factor Analysis

The suitability of the data set for factor analysis was first verified. The Kaiser-Meyer-Olkin (KMO) value was .846, exceeding the recommended value of .6 (Kaiser, 1960), and Bartlett's Test of Sphericity (Bartlett, 1954) indicated that χ^2=1131.733 and was statistically significant (p<.001), confirming the suitability of the data for further analysis. Principal component analysis (PCA) of the 14 items teacher effectiveness scale revealed the presence of three factors with eigenvalues exceeding 1 (5.210, 1.330, and 1.122). These three components explain a total of 37.216 % of the variance. When the scree plot was inspected, it was decided to retain two factors for further investigation. This was further supported by the results of parallel analysis, using the Monte Carlo PCA for parallel analysis (computer software) developed by Watkins (2000). The results showed only two components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (14 items×240 respondents). As the results of the parallel analysis agreed with the number of factors suggested by the scree test, two factors were retained for further analysis (Table 1)

After oblimin rotation, the two factors showed a moderate intercorrelation (r=.516). Inspection of the pattern matrix showed a relatively clear two-factor solution of professionalism and warmth factors. When the structure matrix was analyzed, there was indication of good discrimination between the factors. The communalities give information about how much of the variance in each item is explained, with low values (less than 0.3) indicating that the item does not fit well with the other items in the component (Pallant, 2007). This showed a clear two-factor solution, with professionalism (seven items) and warmth (seven items) factors (Table 2).

Items 1, 2, 4, 6, 7, 9, and 13 loaded on professionalism and items 3, 5, 7, 10, 11, 12, and 14 loaded on warmth. Thus, the construct of professionalism included the ability to communicate in English and explain lessons clearly, fairness in grading and dealing with students, and being an expert in the field. The construct of warmth included the ability to motivate students, encourage participation, be interested in their success, and treat them with respect.

Convergent Validity

As suggested by Fornell & Larker (1981), convergent validity was assessed by calculating the item reliability of each measure, the composite reliability of each

Table 1 Comparison of eigenvalues from PCA and criterion values from parallel analysis

Component	Actual eigenvalue from PCA	Criterion value from parallel analysis	Decision
1	5.210	1.4343	Accept
2	1.330	1.3241	Accept
3	1.122	1.2425	Reject
4	0.927	1.1717	Reject
5	0.895	1.1190	Reject

Table 2 Pattern and structure matrix for PCA with oblimin rotation of a two-factor solution of teacher effectiveness items

Item	Pattern		Structure		Communalities
	Professionalism	Warmth	Professionalism	Warmth	
PROF1	*.754*	−.196	*.726*	−.171	.337
PROF2	*.776*	−.046	*.752*	−.021	.306
PROF3	*.788*	−.184	*.732*	−.112	.347
PROF4	*.709*	.024	*.694*	.012	.468
PROF5	*.705*	−.059	*.732*	−.165	.538
PROF6	*.802*	.054	*.774*	−.022	.601
PROF7	*.759*	.024	*.746*	−.067	.558
WA1	−.035	*.796*	−.026	*.714*	.378
WA2	−.074	*.844*	−.069	*.805*	.652
WA3	.082	*.746*	.071	*.789*	.628
WA4	.008	*.766*	.005	*.770*	.593
WA5	−.079	*.757*	−.072	*.743*	.418
WA6	−.288	*.725*	−.275	*.701*	.409
WA7	.093	*.705*	.075	*.690*	.308

Italicized items indicate major loadings for each item

construct, and the average variance extracted (AVE). Item reliability was assessed by the loadings for each individual item (i.e., the correlation of the items with their respective constructs). According to Hair, Black, Babin & Anderson (2010), Cronbach's alpha tends to understate reliability and so the composite reliability was used instead of Cronbach's alpha. Regarding reliability at the item level, the minimum requirement suggested for factor loading is .7 (Barclay, Higgins & Thompson, 1995; Chin, 1998; Hair et al., 2010; Hulland, 1999). Nunnally & Bernstein (1994) recommended a minimum alpha reliability of .70 at the construct level to reflect adequate reliability. As the two constructs met this suggested minimum value of .7, the final criterion for convergent validity was a measure of the average variance extracted (AVE) for each factor. Results of the analysis showed that the AVE values for all scales were above the .5 minimum value recommended (Fornell & Larker, 1981; Nunnally & Bernstein, 1994). Therefore, the measurement properties satisfied all three necessary criteria of convergent validity (Table 3).

Discriminant Validity

Testing for discriminant validity was the next step in the assessment of the measurement properties. Discriminant validity assesses the degree to which the constructs are empirically different. As suggested by Barclay et al. (1995), discriminant validity is present when the variance shared between a construct and any other construct in the model is less than the variance that construct shares with its measures. The results supported the discriminant validity because, for each construct, the square root of the

Table 3 Item loadings, composite variance, and average variance extracted

Latent variable	Item	Factor loading	Average variance extracted (AVE)	Composite reliability (CR)
Professionalism	PROF1	0.754	.573	.904
	PROF2	0.776		
	PROF3	0.788		
	PROF4	0.709		
	PROF5	0.705		
	PROF6	0.802		
	PROF7	0.759		
Warmth	WA1	0.796	.584	.907
	WA2	0.844		
	WA3	0.746		
	WA4	0.766		
	WA5	0.757		
	WA6	0.725		
	WA7	0.705		

AVE was larger than interconstruct correlation. Hence, discriminant validity was achieved.

The Impact of Teacher and Student Gender on Teaching Effectiveness

A two-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of student and teacher gender on the perceptions of teaching effectiveness of hypothetical math and science teachers. Results indicate a statistically significant interaction effect of student gender and teacher gender on total teacher effectiveness ($F(1, 172)=7.85$, $p=.006$) (Table 4).

Descriptive statistics show that male students rated the female instructors higher in overall teaching effectiveness ($M=3.00$, SD=0.43, for female instructors and $M=2.90$,

Table 4 Two-way ANOVA results (F ratio and eta^2 statistic) for student gender and teacher gender on teaching effectiveness

Total teacher effectiveness	*df*	*F*	*p*	Partial eta squares
Student gender	1	0.57	.45	.003
Teacher gender	1	1.90	.17	.011
Student gender * teacher gender	1	7.85	.006	.044
Error	172	(0.15)		

Computed using alpha=.05. The value in parentheses represents the mean square error. Dependent variable= total effectiveness

SD=0.41, for male instructors), while female students rated the male instructors higher (M=3.13, SD=0.28, for male instructors and M=2.87, SD=0.27, for female instructors) (Table 5).

Another two-way ANOVA was conducted to explore the effect of student and teacher gender on the two subscales—teacher professionalism and teacher warmth. The results indicate a statistically significant interaction effect of student gender and teacher gender on teacher professionalism $F(1, 172)=8.49$, $p=.004$, and teacher warmth $F(1, 172)=4.56$, $p=.034$. The effect sizes were both small (partial eta squared=.047 and .026) based on Cohen's (1988) classification of effect size, with .01 representing a small effect, .06 being a medium effect, and .14 being a large effect (Table 6).

Descriptive statistics show that male students rated female instructors higher for teacher professionalism (M=2.94, SD=0.46, for female instructors; M=2.79, SD=0.44, for male instructors) and teacher warmth (M=3.05, SD=0.45, for female instructors; M=3.02, SD=0.46, for male instructors), whereas female students rated male instructors higher for teacher professionalism (M=3.04, SD=0.34, for male instructors; M=2.78, SD=0.37, for female instructors) and teacher warmth (M=3.22, SD=0.37, for male instructors; M=2.95, SD=0.29, for female instructors) (Table 7).

Discussion

Student evaluations of instructors are an inherent part of educational accountability and improvement (Wilkins & Epps, 2011). As gender stereotypes have been shown to affect faculty evaluations in general (Andersen & Miller, 1997; MacNell et al., 2014; Valian, 1998) and student interest in STEM fields in particular (Shapiro & Williams, 2012; Moss-Racusin et al., 2012), the present experimental study was undertaken to assess the possible effect of gender stereotypes on student perceptions of unfamiliar hypothetical math and science instructors. Given the patriarchal nature of the norms in the Middle East (Moghadam, 2004) and the male-dominated field of STEM education (Riegle-Crumb & King, 2010), the study provides a window into student perceptions of STEM

Table 5 Dependent variable: teaching effectiveness

Student gender	Teacher gender	Mean	Standard deviation	Number of respondents
Male	Male	2.90	0.41	63
	Female	3.00	0.43	62
	Total	2.95	0.42	125
Female	Male	3.13	0.28	24
	Female	2.87	0.27	27
	Total	2.99	0.30	51
Total	Male	2.97	0.39	87
	Female	2.96	0.39	89
	Total	2.96	0.38	176

Table 6 Two-way ANOVA results (F ratio and eta^2 statistic) for student gender and teacher gender on professionalism and warmth

Source		*df*	*F*	*p*	Partial eta squares
Student gender	Teacher professionalism	1	0.48	.49	.003
	Teacher warmth	1	0.44	.51	.003
Teacher gender	Teacher professionalism	1	0.56	.46	.003
	Teacher warmth	1	3.02	.08	.017
Student gender * teacher gender	Teacher professionalism	1	8.49	.004	.047
	Teacher warmth	1	4.56	.034	.026
Error		172	(0.18)		

Computed using alpha=.05. The value in parentheses represents the mean square error. Dependent variable= teacher professionalism and teacher warmth

instructors in an area of the world that is relatively underrepresented in the extant literature.

The United Arab Emirates higher education system presents an interesting case. One of the universities in the current study is segregated by student gender, while the other is co-educational. However, in both universities, students may be instructed by either male or female teachers. Although the United Arab Emirates is an Islamic mainstream society governed by traditional gender norms, the teaching staff at universities consists mainly of expatriates representing a variety of international origins. The sociocultural

Table 7 Dependent variable: teacher professionalism and teacher warmth

	Student gender	Teacher gender	Mean	Standard deviation	Number
Teacher professionalism	Male	Male	2.79	0.44	63
		Female	2.94	0.46	62
		Total	2.86	0.45	125
	Female	Male	3.04	0.34	24
		Female	2.78	0.37	27
		Total	2.90	0.37	51
	Total	Male	2.86	0.43	87
		Female	2.89	0.44	89
		Total	2.88	0.43	176
Teacher warmth	Male	Male	3.02	0.46	63
		Female	3.05	0.45	62
		Total	3.03	0.45	125
	Female	Male	3.22	0.37	24
		Female	2.95	0.29	27
		Total	3.08	0.35	51
	Total	Male	3.08	0.44	87
		Female	3.02	0.41	89
		Total	3.05	0.43	176

climate at United Arab Emirates universities thus provides a unique arena for evaluating perceptions of gender in STEM education.

The results of the present study indicate a statistically significant difference in student perceptions of teacher effectiveness based on the interaction of student and teacher gender. Male students rated the hypothetical female instructor as more effective for math and science courses, whereas female students preferred the male instructor. The present study also looked at the student perceptions of teacher professionalism, which may be considered a stereotypical masculine trait given the history of male instructors in STEM education, and teacher warmth, which may be considered a stereotypical feminine trait. There was a significant cross-gender effect on students' perceptions of teacher professionalism and teacher warmth, with male students rating the hypothetical female instructor higher and female students rating the hypothetical male instructor higher for these attributes.

This is an interesting phenomenon and may reflect the sociocultural norms in the United Arab Emirates. As gender interactions in traditional Muslim societies are often limited to family members, students in the United Arab Emirates may welcome the opportunity to interact with members of the opposite gender in the university setting. As the university setting encourages professional interaction between students and instructors, students may see this as a safe environment for "halal" or permitted conversations and discussions with people of the opposite gender. Additionally, Richardson (2004) noted the tendency of Emirati female students to implicitly defer to male authority figures. As female students in STEM majors in the United Arab Emirates value their fathers' input in choosing their field of study (Mahani & Molki, 2011), the support they receive from male role models in their family may influence their preference for male role models in the classroom, thus resulting in higher evaluations of male instructors compared to female instructors. These findings suggest that female role models may not necessarily play a major role in motivating female students' participation in STEM education in the United Arab Emirates. Instead, given the current findings, an increase in female professors for math and science courses may actually benefit male students.

The perceptions of male and female students on teacher professionalism and teacher warmth also pose some interesting questions for future research. Although female students' preference for male instructors may again reflect the environment in the United Arab Emirates, male instructors may also receive higher ratings from female students due to the fact that the STEM field is predominantly male and traditional beliefs about professionalism in higher education have a tendency to lean in favor of male professors (Basow & Silberg, 1987; Etaugh & Riley, 1983). Male students in the present study, however, expected female professors to display not only more warmth but also more professionalism than male professors. Previous studies have noted that students may perceive female faculty that are distinct minorities in the department as having earned their credentials by being superior to their average male counterparts (Bennett, 1982; Moshavi, Dana, Standifird & Pons, 2008). However, as the present study focused on STEM education rather than the STEM industry, additional research may want to explore the expectations of males in the United Arab Emirates industry to see if the cross-gender effect is applicable there as well.

The aim of the current study was to determine the effect of gender on student perceptions based on initial impression forming, rather than interaction with actual instructors. As people make character judgments on physical appearance in a small amount of time (Willis & Todorov, 2006), it is important to discuss how constructs such as gender can influence these judgments, especially in STEM education where the disparity between genders is particularly pronounced. Future research may want to ascertain the influence of teacher gender on student perceptions of actual teachers, especially in STEM fields. In this regard, researchers may want to address how male and female faculty members approach the teaching of math and science courses. Centra & Gaubatz (2000) noted that female instructors tend to use more discussion-oriented formats whereas male instructors tend to use more lectures. Therefore, it is possible that it is not gender itself, but rather students' expectations of the kind of instruction that female versus male instructors may provide, that would affect their perceptions. These expectations may be based on students' prior experiences with female and male professors or gender stereotypes that students hold. Freeman (1994) found that both male and female students preferred a combination of masculine and feminine traits in their instructors and it was this that influenced their preferences, not the gender of the instructors themselves. As the education climate currently focuses on more student-centered approaches with less emphasis on traditional lectures as modes of instruction, the teaching method used in the classroom may have an important effect on student perceptions.

Conclusion

The present study adds to the current literature on gender bias in higher education by providing the perspective of students in STEM majors at two universities in the United Arab Emirates. The United Arab Emirates is developing at an unprecedented rate, and women in particular are using the favorable government policies to attain higher education. Despite the fact that the United Arab Emirates is highly dependent on oil which necessitates a large number of engineers to support its continued growth, research in STEM education in the country (as well as in the Arabian Gulf region) is lacking. As the country continues to balance its growth with its traditional Islamic values, it is important to address how gender influences the educational system. Although government universities provide gender-segregated campuses to undergraduates, the separation of genders is generally not applicable to the teaching staff. This provides a unique sociocultural environment where students and teachers may be of opposite gender, but students themselves are gender-segregated. The present exploratory study shows some indication of gender bias in student perceptions of science and math instructors in the United Arab Emirates, with female students preferring male instructors and male students preferring female instructors. As the STEM discipline continues to be a male-oriented industry, further research in gender preferences may be useful for student recruitment in the field, especially in the Arabian Gulf region where STEM education is particularly relevant.

Appendix

Imagine that next semester you are assigned to a math class that is taught by the professor in the photo. This professor has recently joined from another university. Although you do not know this person, please rate your level of agreement with the statements below.

Put a tick in the box that most correctly describes your expectations of the professor.

		Strongly disagree	Disagree	Agree	Strongly agree
1	The instructor is an expert in his/her field	1	2	3	4
2	The instructor will speak clearly and use precise English	1	2	3	4
3	The instructor will motivate me to succeed in the class	1	2	3	4
4	The instructor will assess my work fairly	1	2	3	4
5	The instructor will treat me with respect	1	2	3	4
6	The instructor will treat me fairly	1	2	3	4
7	The instructor will explain the lessons clearly	1	2	3	4
8	The instructor will treat students with respect	1	2	3	4
9	The instructor will treat students fairly	1	2	3	4
10	The instructor will motivate students to succeed in the class	1	2	3	4
11	The instructor is interested in student success	1	2	3	4
12	The instructor will encourage students to ask questions and participate in class	1	2	3	4
13	This person will be an excellent instructor for this course	1	2	3	4
14	I want to be in this instructor's class	1	2	3	4

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